

REMARKS

This application stands with claims 1-48 where claims 10-11, 14-16, 26-27, 29-30 and 33-48 are withdrawn. Claims 1 and 17 are independent. Claims 1, 3-5 and 17-20 are amended herein.

I – AMENDED FIGURE 7b

Some changes have been made in red in the enclosed copy of figure 7b. We also include the formal drawing. These changes consist in adding the structure of the activator block 16 in accordance with that of figure 7a. This is supported by the specification (page 52, three last lines).

It is believed to overcome the rejection set forth in the last paragraph of page 2 of the Office Action, as well as the objections to the drawings set forth in section 3 at the bottom of page 4.

II – DEFINITION OF NEUTRON TRANSPARENCY

That notion is defined in the specification in one full sentence: "Transparency is meant as the property of a medium in which neutrons undergo mostly elastic scattering" (page 2, lines 30-32).

The Examiner argues (page 3, last paragraph) that applicant's definition would rather include two steps referred to as (1) and (2) in page 2, line 29-page 3, lines 17 of the specification. This statement of the Examiner is traversed. As indicated here above, "transparency" is unambiguously defined in a full sentence. In addition, step (2) as said by the Examiner simply means that, among the neutron-transparent materials, those having a large

atomic mass are preferred. That portion of the specification cannot be interpreted as implying that transparency would be a property of only light or only heavy nuclei.

In page 3, lines 3+, the specification makes an analogy with optical systems to explain that the target-moderator sphere can be viewed as being diffusive, but highly transparent. In such optical analogy, doping the sphere with a small amount of additional material makes it "cloudy", with most of the neutrons captured by the absorbing impurities. In the context of the present application, it is evident that the "impurities" which "dope" the diffusing medium consist of the material for which exposure to a neutron flux is looked for in the claimed method.

As noted in the first lines of the specification, the invention proposes a method of element transmutation by efficient neutron capture. Also, in page 2, lines 24-28, it is indicated that the increased neutron capture efficiency is achieved with the help of the nature and of the geometry of the medium surrounding the source, in which a small amount of the element to be transmuted ("impurities") is introduced in a diffused way ("doped"). Those skilled in the art immediately understand that what would make the medium "cloudy" in the optical analogy is the isotope in which neutron capture is expected.

Contrary to what the Examiner asserts, Applicant's specification does not specify that neutron capture is occurring within the diffusing medium. Instead, the diffusing medium is said to be transparent, i.e. that neutrons undergo mostly elastic scattering, as opposed to inelastic or capture events.

The Examiner's assertion that the diffusing medium would not be truly elastic does not make sense.

The Examiner further indicates that there would be no indication of what, how much, etc... impurities would be present within the diffusing medium. That observation is believed to be moot once one realizes that the invention does not require impurities within the diffusing medium other than the material to be exposed. Any other neutron-absorbing impurity is rather undesirable in the system according to the invention. What, how much, etc... material to be exposed is needed in the proposed scheme is widely exemplified in the specification.

The Examiner also objects that the definition of transparency given in page 2 of the specification would be "repugnant" to that established in the prior art, as illustrated in a Glossary of 1957. In that Glossary, transparent is defined as "permitting the passage of radiation or particles (opposite of opaque)". Bismuth is given as an example of material highly transparent to neutrons (N.B.: just like in the present specification).

That definition of "transparent to neutrons" is quite consistent with the definition given in the specification. To understand it, let us consider a certain medium receiving a neutron flux. When the neutrons undergo mostly elastic scattering within the medium, each neutron/nucleus collision in the medium generally does not give rise to absorption of the neutrons by the nucleus, so that the neutron is very likely to find its way out the medium, after a certain number of collisions. In other words, passage of the neutrons particles is permitted.

Conversely, if inelastic processes (inelastic scattering, neutron capture, nuclear fission, spallation, ...) are significant within the medium, an impinging neutron will probably be absorbed so that its passage is not "permitted" by the medium which is therefore opaque.

It is thus submitted that Applicant's definition of "transparency" cannot be said to be "repugnant" to the definition referred to by the Examiner.

III – THE BOWMAN REFERENCE

As explained in Applicant's response to the previous Examiner's action, the molten salt medium of Bowman's disclosure is not transparent to neutrons. This holds with Applicant's definition of transparency, and also with the definition given in the 1957 Glossary.

The Examiner did not argue that Bowman's molten sort medium would be transparent. His objection is based on the definition of transparency referred to in the present invention.

Since applicant's definition rather appears to be correct and consistent with definitions given in the prior art, the § 102(b) rejection based on Bowman should not be maintained.

IV – 35 USC §112 OBJECTIONS TO THE SPECIFICATION

The first objection in section 5 of the Office Action results from the Examiner's misunderstanding of the so called "cloudy effect" that according to him, would allow for most of the neutrons to be captured by the impurities provided in the diffusing medium.

As indicated hereabove, it is not a feature of the invention to include impurities within the diffusing medium, except for the material in which neutron capture is desired. The Examiner apparently considers, from a misunderstanding of the word "cloudy" in page 3 that further impurities would be required. This representation is clearly erroneous.

The Examiner also objects to the specification because of the "transparency" issue discussed above.

In this connection, the Examiner has expressed a disagreement with applicant's indication that mainly elastic scattering is occurring within his diffusing medium (i.e., molten lead), by referring to a Manual of 1955, pages 87-88 where inelastic scattering is discussed.

The applicant cannot follow the Examiner's interpretation of that reference. In section 2.100, it explains that "with decreasing mass number of the nucleus there is a general tendency for the excitation energy to increase, so that the neutrons must have higher energies if they are to undergo inelastic scattering. The threshold energy for such scattering in oxygen, for example, is about 6 MeV, and in hydrogen, the process does not occur at all. Exceptions to the foregoing generalizations are the very stable, so called "magic number" nuclei, (...). Heavy nuclei of this type, e.g., lead (82 protons), and bismuth (126 neutrons), behave like light nuclei with respect to inelastic scattering". In other words, inelastic scattering is very rare in lead and bismuth. This is quite consistent with applicant's choice of lead or bismuth as a preferred diffusing medium. In such medium, neutrons undergo mostly elastic scattering, inelastic processes such as inelastic scattering being very unlikely. Lead or bismuth "behave like light nuclei with respect to inelastic scattering", for example like hydrogen in which "the process does not occur at all".

It cannot be understood what contradiction the Examiner found between the 1955 Manual and applicant's disclosure. In particular, the Examiner's interpretation of the prior art as indicating that lead/bismuth act as inelastic scatterers is clearly incorrect.

V – INNER / OUTER BUFFER REGIONS

In section 7 of the Office Action, the Examiner says that the use of such language would not be supported in the specification.

This is very surprising, because the specification discloses a first buffer layer 3 (page 51, line 22) which figure 7a shows to be located in the inner region of the assembly surrounded by the portion 4 of the neutron-diffusing medium where the material to be exposed is distributed ("activation layer", see e.g., page 53, lines 26-29). The specification also discloses, for some embodiments of the invention, a further lead buffer layer 5 (page 54, lines 14-16) which figure 7a shows to be located around the activation layer 4.

Although applicant was forced by the Examiner to elect one of figures 7a and 7b, it remains that the features of figure 7a also belong to the embodiment of figure 7b as indicated previously (page 52, lines 34-36).

The Examiner's reasoning is difficult to follow, because he objects in particular to claims 1 and 17 because of the use of the terms "inner buffer region" and "outer buffer region". However, claims 1 and 17 do not recite an outer buffer region. Claims 1 and 17 only call for an inner buffer region, that is a region of the diffusing medium which acts as a buffer (page 51, lines 22-28), and which is said to be "inner" because it is surrounded by the activation volume, i.e. the portion of the neutron diffusing medium where the material is distributed.

Therefore, the rejection of claims 1 and 17 on this ground is believed to be improper. The outer buffer region is only recited in claims 5 and 20, which do not specify whether or not there would be any intermixing of the two buffer regions (this is in fact irrelevant).

The foregoing comment also applies to section 9b-c of the Office Action.

VI – USE OF THE TERM "PORTION"

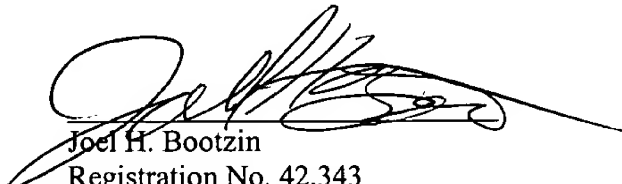
The use of that term is objected to by the Examiner since, according to him, it would be a relative term rendering the claims indefinite.

Although we disagree with this objection, we replaced the word "portion" with "activation region" as supported, e.g., by the first line of page 53 of the specification. We made such changes in claims 1, 3-5 and 17-20.

For all of the reasons mentioned above, Applicant respectfully requests reconsideration and allowance of all pending claims. The Examiner is invited to contact the undersigned attorney in order to expedite prosecution.

By a separate paper, Applicant submits herewith the fee for a one-month extension of time to respond to the instant Office Action. The Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 18-2284 of Piper Rudnick LLP, duplicate copy attached.

Respectfully submitted,


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